

# Concentrating Solar Power

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## Dish/Engine Technology

- Solar energy is concentrated through mirrored array onto a thermal receiver
- Heat is converted to three-phase 480-volts electricity by a Stirling engine
- Solar-to-electric conversion as high as 30%, significantly higher than any other solar technology
- 5-kW to 25-kW systems ideal for rural applications
- Multiple dishes can be connected for increased power needs.



SAIC's 2<sup>nd</sup> Generation 25-kW Hybrid Dish/Stirling System at Golden, Colorado



SEGS Troughs at Kramer Junction, California

## Trough Technology

- Solar energy reflected by parabolic troughs onto the heat collection element
- Circulated synthetic oil absorbs the sun's energy and is used to create steam for the generation of electricity with conventional turbines
- 30-MW to 80-MW systems provide a wide range of applications
- 354 MW of trough fields are currently operating in the United States
- Commercial plant operations have optimized performance, reduced costs, and improved efficiencies.

## Power Tower Technology

- Solar energy is reflected by a field of mirrors (heliostats) to a receiver atop a centrally located tower.
- Molten salt, the heat transfer fluid, flows through the receiver to absorb the sun's energy, and is used to create steam for the generation of electricity with conventional steam turbines.
- The ability to store heat in the form of molten salt makes it possible to generate electricity at any time of the day, not just while the heliostats are receiving solar energy.
- Solar Two, a 10-MW demonstration project, is currently operating successfully in California.
- 30-MW to 200-MW systems are projected to offer the lowest cost electricity produced from solar energy.



Solar Two at Daggett, California

**Concentrating Solar Power Technology Status and Projected Cost**

Type of Technology	Technology Status	Unit Capacity	Capital Costs (US\$/kWh)	O&M (US\$/kWh)	Levelized Energy Cost (US\$/kWh)	
					Year 2000	Year 2010
Dish/Engines	Early Technical Feasibility	5 kW to 50 kW	\$2,900	2.0	8.6 - 13.0	4.0 - 6.0
Troughs	Early Commercial Evolution	30 MW to 80 MW	\$2,900	1.0	6.8 - 11.2	5.6 - 9.1
Power Towers	Demonstrated Technical Feasibility	30 MW to 200 MW	\$2,400 To \$2,900	0.7	5.2 - 8.6	3.3 - 5.4

Concentrating solar power (CSP) technologies (previously referred to as solar thermal electric technologies) use mirrors to concentrate the sun's energy up to 10,000 times to power conventional turbines or heat engines to generate electricity. This clean, secure, environmental friendly power has the potential for major impacts in international markets and diversifies our options for domestic electricity production. Energy from CSP systems is high-value renewable power because energy storage and hybrid designs allow it to be provided on-demand—even when the sun is not shining.